

We claim:

1. A method for modifying electrical properties of papermaking compositions, said method comprising the steps of:

providing at least one papermaking composition comprising a colloid phase, an aqueous phase, and optionally pulp fibers, wherein each of the colloid phase, aqueous phase, and optional pulp fibers of one of the at least one papermaking composition has an electrical property and an associated value based upon the electrical property;

introducing carbon dioxide into at least one of the at least one papermaking composition in an amount such that the associated electrical property value is substantially adjusted.

2. The method of 1, wherein:

the at least one papermaking composition further comprises solid calcium carbonate;

at least a portion of the solid calcium carbonate is dissolved upon said step of introducing carbon dioxide.

3. The method of claim 1, further comprising the steps of:

selecting first, second, third, and optional fourth papermaking compositions as the at least one papermaking composition, wherein

the first papermaking composition is a pulp slurry that includes pulp fibers,

the second papermaking composition is broke that includes pulp fibers,

the third papermaking composition is whitewater which does not include a substantial amount of pulp fibers, and

the optional fourth papermaking composition is a diluted version of the first papermaking composition;

optionally diluting the first papermaking composition thereby providing the optional fourth papermaking composition;

allowing the pulp fibers of the first or optional fourth papermaking composition to be dewatered on a papermaking wire downstream of the vessel, and at which the second and third papermaking compositions are produced.

4. The method of claim 3, further comprising the steps of:

selecting the first papermaking composition as the at least one papermaking composition into which carbon dioxide is introduced.

5. The method of claim 3, further comprising the steps of:

selecting the second papermaking composition as the at least one papermaking composition into which carbon dioxide is introduced.

6. The method of claim 3, further comprising the steps of:

selecting the third papermaking composition as the at least one papermaking composition into which carbon dioxide is introduced.

7. The method of claim 3, further comprising:

selecting dilution of the first papermaking composition as said step of optionally diluting the first papermaking composition, thereby providing the fourth papermaking composition;

selecting the provided optional fourth papermaking composition as the at least one papermaking composition into which carbon dioxide is introduced.

8. The method of claim 3, wherein:

the associated electrical property value is based upon zeta potential.

9. The method of claim 3, wherein:

the associated electrical property value is based upon conductivity.

10. The method of claim 3, wherein:

the associated electrical property value is based upon electrical charge demand.

11. The method of claim 3, wherein:

the associated electrical property value is based upon streaming potential.

~~12~~ ¹² 11.1 The method of claim 1, further comprising the steps of:

selecting a predetermined value or predetermined range of values based upon the electrical property; and

measuring the electrical property of at least one of the colloid phase, aqueous phase and optional pulp fibers of at least one of the at least one papermaking composition thereby obtained a measured value, wherein the adjusted value is closer to the predetermined value or range of values than the measured value.

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~~13~~ ¹² 12. The method of claim ~~11.1~~, further comprising the steps of:

comparing the measured value to the predetermined value or range of values;

selecting an amount of the introduced carbon dioxide based upon said comparing step.

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~~14~~ 13. The method of claim 8, wherein:

the associated zeta potential value of at least one of the colloid phase and optional fibers of at least one of the first, second, third and optional fourth papermaking compositions is negative and adjustment thereof renders it less negative.

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~~15~~ 14. The method of claim 8, wherein:

the associated zeta potential value of at least one of the colloid phase and optional fibers of at least one of the first, second, third and optional fourth papermaking compositions is positive and adjustment thereof renders it less positive.

16 ~~16~~. The method of claim 9, wherein:

the associated conductivity value of at least one of the colloid phase and optional fibers of at least one of the first, second, third and optional fourth papermaking compositions is increased by the adjustment.

17 ~~16~~. The method of claim 10, wherein:

the associated conductivity value of at least one of the colloid phase and optional fibers of at least one of the first, second, third and optional fourth papermaking compositions is decreased by the adjustment.

18 ~~17~~. The method of claim 1, wherein:

the at least one papermaking composition into which carbon dioxide is introduced includes pulp fibers present at a consistency of at least 3%.

19 ~~18~~. The method of claim 8, wherein:

the at least one papermaking composition into which carbon dioxide is introduced includes pulp fibers present at a consistency of at least 3%.

20 ~~19~~. The method of claim ¹²~~11~~, wherein:

the at least one papermaking composition into which carbon dioxide is introduced includes pulp fibers present at a consistency of at least 3%.

21 ~~20~~. The method of claim 13, wherein:

the at least one papermaking composition into which carbon dioxide is introduced includes pulp fibers present at a consistency of at least 3%.

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~~20.1~~. The method of claim 14, wherein:

the at least one papermaking composition into which carbon dioxide is introduced includes pulp fibers present at a consistency of at least 3%.

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~~21~~. The method of claim 12, further comprising the step of:

controlling the amount of carbon dioxide introduced with a regulating device, the regulating device performing said comparing step.

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~~22~~. The method of claim 21, wherein the regulating device includes a programmable logic controller.

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~~24~~. The method of claim 3, further comprising the step of:

selecting dilution of the first papermaking composition as said step of optionally diluting the first papermaking composition, thereby providing the fourth papermaking composition;

providing a pulp chest for providing a supply of the first papermaking composition;

providing a headbox which receives the fourth papermaking composition and distributes the pulp fibers therein across an upper surface of the paperwire, the headbox being downstream of the pulp chest; and

selecting a point whereat the carbon dioxide is introduced, the selected point being at or downstream of the pulp chest and non-adjacently upstream of the headbox.

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~~25~~. The method of claim 3, further comprising the steps of:

selecting zeta potential as the electrical property;

selecting the first papermaking composition as the at least one papermaking composition into which carbon dioxide is introduced;

selecting a consistency of fibers for the first papermaking composition of at least 3%;

selecting a predetermined zeta potential value or range of values;

measuring the zeta potential of at least one of the colloid phase, aqueous phase and optional fibers;

comparing the measured value to the predetermined value or range of values;

and

selecting an amount of the introduced carbon dioxide based upon said comparing step.

27 26. The method of claim 3, further comprising the steps of:

selecting dilution of the first papermaking composition as said step of optionally diluting the first papermaking composition, thereby providing the fourth papermaking composition;

selecting zeta potential as the electrical property;

selecting the fourth papermaking composition as the at least one papermaking composition into which carbon dioxide is introduced;

selecting a predetermined zeta potential value or range of values;

measuring the zeta potential of at least one of the colloid phase, aqueous phase and optional fibers;

comparing the measured value to the predetermined value; and

selecting an amount of the introduced carbon dioxide based upon said comparing step.

28 25. The method of claim 3, further comprising the steps of:

selecting zeta potential as the electrical property;
selecting the second papermaking composition as the at least one papermaking composition into which carbon dioxide is introduced;
selecting a predetermined zeta potential value or range of values;
measuring the zeta potential of at least one of the colloid phase, aqueous phase and optional fibers;
comparing the measured value to the predetermined value or range of values;
and
selecting an amount of the introduced carbon dioxide based upon said comparing step.

²⁹~~26~~. The method of claim 3, further comprising the steps of:
selecting zeta potential as the electrical property;
selecting the third papermaking composition as the at least one papermaking composition into which carbon dioxide is introduced;
selecting a predetermined zeta potential value or range of values;
measuring the zeta potential of at least one of the colloid phase, aqueous phase and optional fibers;
comparing the measured value to the predetermined value or range of values;
and
selecting an amount of the introduced carbon dioxide based upon said comparing step.

³⁰~~27~~. The method of claim 3, further comprising the steps of:

selecting a predetermined value or range of values based upon the electrical property; and

measuring the electrical property of at least one of the colloid phase, aqueous phase and optional pulp fibers of at least one of the at least one papermaking composition thereby obtained a measured value, wherein the adjusted value is closer to the predetermined value than the measured value.

~~30~~28. A method for reducing an amount of chemical additives introduced to a papermaking composition, said method comprising the steps of:

providing at least one papermaking composition comprising a colloid phase, an aqueous phase, and optionally pulp fibers, wherein each of the colloid phase, aqueous phase, and optional pulp fibers of one of the at least one papermaking composition has an electrical property and an associated value based upon the electrical property;

introducing an amount of chemical additives into at least one of the at least one papermaking composition;

introducing an amount of carbon dioxide into the at least one of the at least one papermaking composition into which the chemical additives are introduced while at the same time reducing the amount of the chemical additives, the amount of carbon dioxide is such that the associated electrical property value is substantially adjusted.